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SOUNDPROOF FLOORING

(Bōon Yukazai)

Takashi Terayama and Yozo Mihara

UNITED STATES PATENT AND TRADEMARK OFFICE

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I. Title of the Invention

Soundproof Flooring

II. Claims

A soundproof flooring combining a plywood, a soundproof material, etc. and composed of multiple layers, characterized by that

the layers are bound with an adhesive and a non-adherent portion is provided in at least one space between the layers.

III. Detailed Description of the Invention

[Field of Industrial Application]

This invention relates to a soundproof flooring, and particularly relates to a composite soundproof flooring which is mainly fixed with an adhesive on a concrete face prepared with a smooth surface, a plywood or a floor backing material such as a particle board, etc. to reduce floor impact noise.

[Prior Art]

Recently, a case of applying a wooden flooring to a mansion and a house increases, and various methods were proposed before to

¹Numbers in the margin indicate pagination in the foreign text.

reduce floor impact noise in this case. A method of dividing the

floor into several layers and combining different materials is general in the case of wooden flooring for the reduction of floor impact noise. In this case, a method of applying an adhesive over the whole surface was adopted in binding the layers.

[Subject to Be Solved by the Invention]

However, if viewing in the aspect of reducing the floor impact noise, the non-adherent way is rather effective. This is because the friction works between the layers to convert a part of floor impact force to heat, thus the impact is damped more effectively than the fixation with an adhesive. However, from the dimensional stability and the quality control of product, it is not suitable that all the layers are not bound. It is also not suitable by considering the safety in the life of residents. Thus, there is a contrary relation between the reduction of floor impact noise and the adhesion. Accordingly, the purpose of this invention consists in providing a soundproof flooring which displays an excellent impact noise-damping effect without impairing the product quality in the manufacture of a laminated wooden composite flooring.

[Means for Solving the Subject]

The inventors made a study to solve the above subject, consequently they discovered that it is suitable to take an adhesion

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structure which is regular but is not bound over the whole surface as a means approaching to a more non-adherent state and a state that the quality control can be fully taken.

Namely, this invention is a soundproof flooring combining a plywood, a soundproof material, etc. and composed of multiple layers which is characterized by that the layers are bound with an adhesive and a non-adherent portion is provided in at least one space between the layers.

This invention is described in detail below.

First, the soundproof flooring mentioned here means that in a wooden flooring aiming at reducing the floor impact noise, the flooring is divided into multiple layers and various materials are stacked one over another. The adhesives in this invention is a concept also including sticking agents, therefore a sticking tape can also be used as a film-like or sheet-like adhesive.

A means for applying an adhesive in spots, lines or grids is considered as means for providing the non-adherent port. Ellipse, triangle, quadrangle, etc. are considered as shapes in the case of spots, but making into a complicated shape has no much meanings. The size of spots relates to materials forming the layers. In a case of fiber materials or materials without smooth surface, the size of spots must be such a size that they are not too much small and do not reduce the stability of product. However, when the spots are extremely large, it is not suitable because the shape becomes a

shape same as the whole-surface adhesion. The size in a range of diameter 1 - 5 cm is desirable, e. g. in a case of shape of circular spots. The same way of thinking is also mentioned in the case of applying an adhesive in lines or grids. The spacing in the adhesive application also relates to materials forming the layers. For example, if the spacing of adhesive is too large in the case of fiber materials or materials with unsmooth surface, this is undesirable in product quality. The spacing cannot be stated without exceptions because it also relates to both the size of spots and the thickness of lines in the application of adhesive, and a spacing of 1 - 10 cm is desirable.

Here, it is desirable that the shape, spacing, coating weight, etc. are regular. This is because keeping the quality of product constant is effective. A means similar to a mask of pattern printing, etc. in which nozzles of bead-like application are arranged at a constant spacing, a pattern is attached to coating rolls of a roll coater and an adhesive is extruded from the internal of said coating rolls, etc. are considered as a regular coating means.

A film-like or a sheet-like adhesive can also be used as one of means of applying adhesive. At this time, a correspondence is made possible by opening holes on the film to provide a non-adherent portion, but it is desirable that the shape and spacing, distribution, etc. of holes are regular and accordingly the shape,

spacing, distribution, etc. of the adherent portion are regular, which are same as the case of adhesive application.

The adhesion structure of said soundproof flooring of this invention is illustrated in more detail based on drawings below.

Fig. 1 shows one construction example of a soundproof flooring of this invention and is a vertical sectional view showing a state that layers of a plywood **1**, a punched plywood **2** and a non-woven fabric are discontinuously joined with an adhesive **4** and is provided with a portion without applying the adhesive, i. e., a non-adherent portion **5**. Thus, this invention has an adhesion structure in which layers not bound over the whole surface exist, but all the layers may be not necessarily bound in part or layers bound over the whole surface may be in many layers. To which extent such whole-surface binding layers are interposed as necessary can be considered according to the stability and the safety of product as well as objective properties. Fig. 2 - Fig. 4 are modal views showing several modes for applying the adhesive **4** onto the plywood, Fig. 2 shows a case that the adhesive is applied in spots and Fig. 3 shows a case that the adhesive is applied in lines, respectively. Fig. 5 is an oblique view showing a mode that a punched film **6** is pasted onto the plywood **1**. The modes shown in these drawings are merely exemplified to the end, of course, these modes can be changed anyway in the scope of this invention without sticking to these drawings.

[Functions]

This invention ensures the safety as a product of soundproof flooring and is hard to cause problem with the safety of residents such as tilting, etc. because the layers of said composite flooring are bound partly and regularly according to demand. This invention

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enables to effectively reduce the floor impact noise at junctions between the layers because it has a non-adherent portion and a part of floor impact noise is converted to friction heat in this portion.

[Actual Examples]

Actual examples of this invention are illustrated below.

Materials used in the actual examples:

1. JAS common plywood: thickness 4 mm
2. Punched plywood: a plywood in which 7 mm-diameter holes are punched at a spacing of 3 cm in JAS common plywood
3. Non-woven fabric: Toabs DF600
4. Adhesive: an aqueous polymeric isocyanate KR120 made by Koyo Industry Co.

As shown in Fig. 1, the soundproof flooring is constructed in the order of common plywood, non-woven fabric, punched plywood and non-woven fabric from the top, and the adhesive given between the layers are applied in lines as shown in Fig. 3.

Actual Example 1: 50 mm-wide adhesive lines were drawn at a spacing of 150 mm so that the ratio of adhesive coated area to the whole joined surface became 25%.

Actual Example 2: 50 mm-wide adhesive lines were drawn at a spacing of 50 mm so that the ratio of adhesive coated area to the whole joined surface became 50%.

Actual Example 3: 50 mm-wide adhesive lines were drawn at a spacing of 11 mm so that the ratio of adhesive coated area to the whole joined surface became 75%.

In the above actual examples, the thickness of adhesive was taken as 0.5 mm. The application was carried out by same pattern for all the layers.

The determination of light impact noise was made by a tapping machine according to JIS A-1418 "Method for Determining Floor impact Noise Level on Building Site". Determination values at central frequencies of tapping zone 125 Hz, 250 Hz which clearly manifest an effect on reducing the floor impact noise are shown in Table 1. A sample in which the layers were not bound and simply stacked up (Comparison Example 1) and a sample in which the layers were bound on the whole surface (Comparison Example 2) were similarly determined. Results are shown in Table 1.

Table 1

		Actual Example			Comparative Example	
		1	2	3	1	2
Ratio of adhesive coated area to whole joined surface %		20	80	78	0	100
Floor impact noise level dB	125 Hz	63	64	66	62	65
	250 Hz	55	57	61	58	60

[Effects of the Invention]

This invention enables to provide a wooden soundproof flooring which has good stability of product and displays an excellent effect on the reduction of a light impact noise, thus it has extremely large practical effect.

IV. Brief Description of Drawings

Fig. 1 shows one construction example of soundproof flooring of this invention, Fig. 2 - Fig. 4 are modal views showing some application modes of adhesive, and Fig. 5 is oblique view showing one construction example in case of using a punched adhesive film.

- 1 — plywood
- 2 — punched plywood
- 3 — non-woven fabric
- 4 — adhesive
- 5 — non-adherent portion

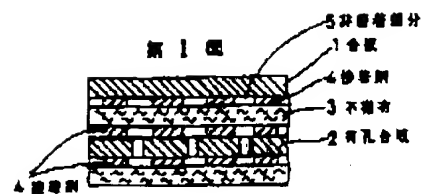
- 6 — adhesive film
- 7 — hole

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Fig. 1

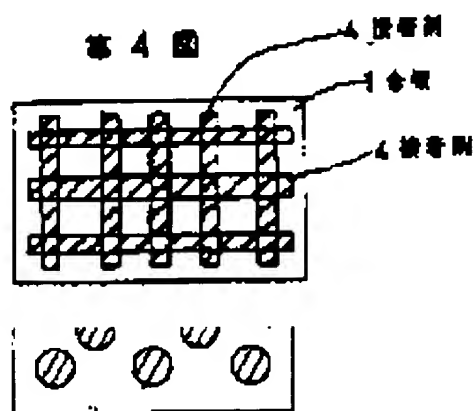
- 1 — plywood
- 2 — punched plywood
- 3 — non-woven fabric
- 4 — adhesive
- 5 — non-adherent portion

Fig. 2



- 1 plywood
- 4 adhesive

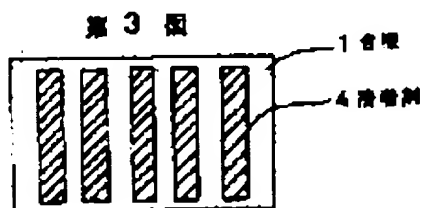
Fig. 3



- 1 plywood
- 4 adhesive

Fig. 4

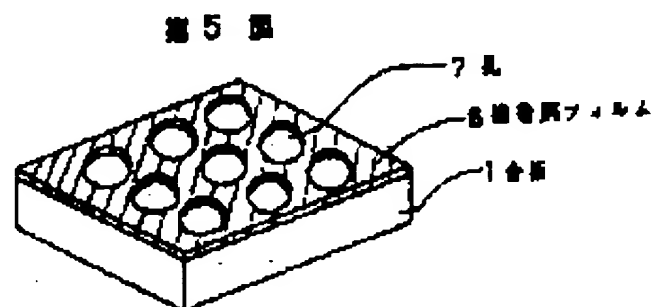
- 1 plywood



4 adhesive

Fig. 5

1 plywood
6 adhesive film
7 hole



PATENT ABSTRACTS OF JAPAN

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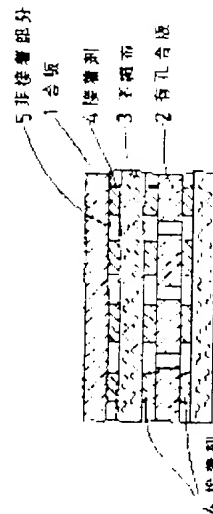
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MIHARA YOZO

(54) SOUNDPROOF FLOORING

(57)Abstract:

PURPOSE: To enhance impact-noise damping effects by sticking plywood and soundproof material, etc., to each other by means of an adhesive and stacking them on one another, and providing a non-adherent portion in at least one space between the layers of plywood and soundproof material.

CONSTITUTION: Layers of plywood 1, holed plywood 2 and nonwoven fabric 3 are discontinuously joined together by an adhesive 4 and a non-adherent portion 5 to which the adhesive 4 is not applied is provided. The layers are fixed using the adhesive to a concrete face the surface of which is smoothly prepared, or to floor base material of plywood, particle boards and the like so as to reduce floor impact noise.



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審査請求 未請求 請求項の数 1 (全4頁)

⑥ 発明の名称 防音床材

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明 細 書

1. 発明の名称

防音床材

2. 特許請求の範囲

合板、遮音材等と組み合わせ、複数の層によって構成される防音床材において各層は接着剤によって接着されると共に、少なくとも二つの層間においては非接着部分を設けて接着されていることを特徴とする防音床材。

3. 発明の詳細な説明

(産業上の利用分野)

本発明は防音床材に係り、特に床衝撃音を軽減するために表面が平滑に整備されたコンクリート面もしくは合板やパーティクルボードなどの床下地材料に主として接着剤を用いて固定される複合防音床材に関する。

(従来の技術)

近年マンションや住宅に木質床材を施工する場合が増加しており、その場合、床衝撃音を軽減するには従来様々な方法が提案されてきた。床衝撃

音の軽減には木質系床材の場合、幾つかの層に分断して異種材料を組み合わせる方法が一般的である。この場合、各層を接着するに当たっては接着面全体に接着剤を塗布する方法が採用されていた。(発明が解決しようとする課題)

しかし、床衝撃音の軽減という面から見れば、むしろ接着しない方が効果がある。これは各層のあいだに摩擦が働いて床衝撃力の一部が熱に変換されるためで、接着による固定よりも効果的に衝撃が減衰される。しかし、各層を全く接着しないということは製品の寸法安定性や品質管理の面から適当ではない。また、居住者の生活の中の安全性を考えた場合も適当ではない。このように床衝撃音の軽減と接着との関係には相反するものがあつた。従つて、本発明の目的とするところは、積層型の木質系複合防音床材の製造に際し、製品品質を損なうことなく優れた衝撃音減衰効果を発揮する防音床材を提供することにある。

(課題を解決するための手段)

本発明者らは上記課題を解決するため研究を行つ

た結果、より接着しない状態に近づけ、且つ品質管理を充分に行なえる状況に近づける手段として、規則的ではあるが、全面には接着しない接着構造とする事が適当であることを見出した。

即ち、合板、遮音材等を組み合わせて、抽放の層によって構成される防音床材において各層は接着剤によって接着されると共に、少なくとも一つの層間においては非接着部分を設けて接着されていることを特徴とする防音床材である。

以下、本発明を詳細に説明する。

先ず、ここでいう複合床材とは、床衝撃音の軽減を目的とした木質系床材の中で、床材を幾つかの層に分割し、各種材料を兼ね合わせたものをいう。また本発明において用いる接着剤は粘着剤も含めた概念であり、従って、フィルム状もしくはシート状接着剤には粘着テープも使用できる。

非接着部を設ける手段としては、点状、線状、格子状に接着剤を塗布する手段が考えられる。点状の場合の形状は丸、楕円、三角、四角などが考えられるが、複雑な形状にしてもあまり意味がな

い。点の大きさは各層を構成する材料に関係する。もし遮音材料や表面が平滑でない材料の場合には点の大きさがあまり小さすぎると製品の安定性が低下するのである程度の大きさが必要である。しかし点が極端に大きい場合には、全面接着と同じようなものになってしまう。適当ではない。従って、例えば円形の点状の場合、直径1～5cm程度の大きさが望ましい。同様の考え方が線状や格子状に接着剤を塗布する場合にも言え、幅は1～5cmの範囲が望ましい。接着剤塗布の間隔も各層を構成する材料に関係する。例えば、遮音材料や表面が平滑でない材料の場合には間隔をあげ過ぎると製品品質上好ましくない。接着剤の塗布の点の大きさや線の間隔とも関係するので一概には言えないが、1～10cmの間隔が望ましい。

ここで、接着剤塗布の形状や間隔、塗布量などは規則的であることが望ましい。これは、製品の品質を一定に保つのに有効であるからである。規則的な塗布手段としてはボード状塗布のノズルを一定間隔で置き、ロールコーターの塗布ロール上

へのパターン付け、塗布ロールの内部から接着剤が押し出されるもの、パターン印刷のマスクと似た手段等が考えられる。

また、接着剤の塗布手段のひとつとしてフィルム状もしくはシート状接着剤をもちいることもできる。このとき、フィルムに孔をあけるなどして接着しない部分を設けることにより対応が可能であるが、孔の形状や間隔、分布などが規則的であること、従ってまた、接着部分の形状、間隔、分布などが規則的であることが望ましいのは接着剤塗布の場合と同様である。

次に図面に基いて本発明の防音床材の接着構造についてさらに具体的に説明する。

第1図は本発明防音床材の一構成例を示すもので、合板1、有孔合板2、不織布3の各層が接着剤4で不連続に接合された状態を示す縦断面図であって、接着剤を塗布していない部分即ち非接着部分5を設けたものである。このように本発明では全面には接着されていない層が存在する接着構造を有するものであるが、必ずしも全部の層が部分接

着でなくてもよく、多数の層の内には全面に接着された層があってもよい。この様な全面接着層を必要によりどの程度介在させるかについては、製品の安定性や安全性及び目的とする性能に応じて考慮することができる。また第2図～第5図は合板の上に接着剤4を塗布した幾つかの態様を示す模式図であって、第2図は点状に接着剤を塗布した場合、第3図は線状に接着剤を塗布した場合をそれぞれ大々示すものである。さらに第4図は孔のあいた接着剤フィルム5を合板1上に貼付した態様を示す斜視図である。なおこれらの図に示された態様はあくまでも例示にすぎないものでありその態様はこれらの図にこだわることなく本発明の範囲内で如何様にも変わりうることは言うまでもない。

〔作 用〕

本発明によれば、複合床材の各層が部分的かつ必要により規則的に接着されているため防音床の製品としての安定性が確保され、また、めくれ上がりなど居住者の安全性にかかわる問題は生じな

く、更に接着しない部分があるため、その部分では床衝撃音の一部が摩擦熱と変換されるので各層間の接合部において床衝撃音を効果的に軽減で切る。

(実施例)

以下に本発明の実施例を説明する。

本実施例に用いた材料、

1. JAS普通合板・厚さ4mm
2. 有孔合板：JAS普通合板に3mm間隔で7mm径の孔をあけたもの
3. 不織布：東亜紡 DFB000
4. 接着剤：水性高分子イソシアネート系（光硬化型）KR120

防音床材の構成は第1図に示す如く、上から、普通合板、不織布、有孔合板、不織布の順で構成し、各層間に塗される接着剤は第3図に示す如く線状に塗布した。

実施例1：全接合面に対する接着剤塗布面積の割合が2.5%となるように5.0mm幅の接着剤の線15.0mm間隔に引いた。

実施例2：全接合面に対する接着剤塗布面積の割合が5.0%となるように5.0mm幅の接着剤の線5.0mm間隔に引いた。

実施例3：全接合面に対する接着剤塗布面積の割合が7.5%となるように5.0mm幅の接着剤の線3.3mm間隔に引いた。

上記各実施例において、各接着剤の厚さは0.5mmとした。塗布は、各層とも同じパターンで行った。

JIS S-2418「建築現場における床衝撃音レベルの測定方法」に基づいてタッピングマシンにより軽量衝撃音の測定を行った。床衝撃音の軽減効果が明確に現れるオクターブ帯域中心周波数125Hz, 250Hzの測定値を第1表に示す。尚、比較のため、各層を接着せず単に重ね合わせただけの物（比較例1）、各層を全面接着した物（比較例2）についても同様に測定を行った。結果を第1表に示す。

第 1 表

	実施例			比較例		
	1	2	3	1	2	
全接合面に対する 接着剤塗布面積の 割合（％）	2.5	5.0	7.5	0	10.0	
床衝撃音 レベル (dB)	125 Hz	6.3	6.4	6.6	6.2	6.8
	250 Hz	5.5	5.7	6.1	5.5	6.3

(発明の効果)

本発明によれば、製品の安定性が良好で、しかも、軽量衝撃音の軽減に優れた効果を発揮する木質系防音床材を提供することが可能となるものであり、実用上の効果は極めて大なるものがある。

4. 図面の簡単な説明

第1図は本発明防音床材の構成例を示す縦断面図、第2図～第4図は接着剤のいくつかの塗布態様を示す模式図、第5図は孔のあいた接着剤フィルムを用いた場合の一構成例を示す斜視図である。

- 1 ……合板
- 2 ……有孔合板
- 3 ……不織布
- 4 ……接着剤
- 5 ……非接着部分
- 6 ……接着剤フィルム
- 7 ……孔

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